

We Claim:

1. An attitude detection apparatus for initial motion control for moving a load over a predetermined path having at least one attitude, such load having a drive means connected to a power supply source, said attitude detection apparatus comprising:

(a) at least one attitude sensor means disposed in a stationary position in respect to such moving load and substantially aligned with a directional axis of such at least one attitude for measuring such at least one attitude of such load, said at least one attitude sensor means providing at least one attitude proportional signal;

(b) a sensor power supply connected to said at least one attitude sensor means enabling operation thereof;

(c) a comparator means connected to said at least one attitude sensor means for receiving said at least one attitude proportional signal and comparing it against a predetermined threshold value defining a substantially level terrain attitude and for providing at least one drive signal, said predetermined threshold value being fixed with at least one of position and motion of such load; and

(d) a means connected to said comparator means for receiving said at least one drive signal and at least one command input signal and for providing at least one control

output signal of a predetermined value to such load drive means, said at least one control output signal enabling such load drive means to compensate for such at least one attitude prior to moving such load.

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2. In a door system at least partially disposed within an aperture of a vehicle operating on at least one terrain attitude, said door system having at least one door disposed for movement within such aperture for at least partially covering  
10 and uncovering thereof, a door support means coupled to such at least one door, a door drive means connected to such at least one door for driving thereof, such movement at least partially controlled by an attitude detection apparatus comprising:

(a) at least one attitude sensor means disposed in a  
15 stationary position in respect to such at least one door and substantially aligned with a directional axis of such at least one terrain attitude, said at least one attitude sensor means for measuring such at least one attitude of such at least one door and for providing at least one attitude proportional  
20 signal;

(b) a sensor power supply connected to said at least one attitude sensor means enabling operation thereof;

(c) a comparator means connected to said at least one attitude sensor means for receiving said at least one attitude

proportional signal and comparing it against a predetermined threshold defining a substantially level terrain attitude and for providing at least one drive signal, said predetermined threshold value being fixed with at least one of position and motion of said at least one door; and

(d) a means connected to said comparator means for receiving said at least one drive signal and at least one command input signal and for providing at least one control output signal of a predetermined value to such door drive means, said at least one control output signal enabling such door drive means to compensate for such at least one terrain attitude prior to moving such at least one door.

3. The door system according to claim 2 wherein said at least one attitude sensor means is selected from a group of inclinometer technologies consisting of an accelerometer, a capacitive tilt sensor, an electrolytic tilt sensor, a gas bubble in liquid, a mercury tilt sensor, and a pendulum being a rotary shaft encoder coupled to a weight.

4. The door system according to claim 3 wherein said accelerometer is selected from a group consisting of a capacitive, an electromechanical servo, a resonating beam, a piezoelectric, a piezoresistive, a piezo film, a bulk

micromachined piezoresistive, a bulk micromachined capacitive, a bulk micromachined resonating beam, and a surface micromachined capacitive.

5           5. The door system according to claim 2 wherein said at least one attitude sensor means includes a transmitter for wirelessly transmitting said least one attitude proportional signal.

10           6. The door system according to claim 2 wherein said door system further includes at least one calibrating sensor means for measuring one of shock, vibration and a combination thereof.

15           7. The door system according to claim 2 wherein said door system further includes a temperature sensor means compensating for temperature effects on said at least one attitude sensor means.

20           8. The door system according to claim 2 wherein said door system further includes a speed sensor means compensating for a vehicle speed effect on said at least one attitude sensor means.

          9. The door system according to claim 5 wherein said comparator means includes a receiver for wirelessly receiving

said least one attitude proportional signal transmitted by said transmitter.

10. The door system according to claim 2 wherein said driver means provides at least one directional feedback signal for enabling said comparator means to provide a predetermined value of said at least one drive signal proportional to a direction of said door movement.

10 11. The door system according to claim 2 wherein at least said at least one attitude sensor means and said comparator means are encased within an enclosure.

12. A powered door system for enabling passenger ingress and egress through an aperture of a vehicle operating on at least one terrain attitude, said powered door system comprising:

(a) a door adapted for movement in a first direction to at least partially uncover such aperture and in a second direction to at least partially cover such aperture;

20 (b) a door support member disposed adjacent such aperture and connected to said door with at least one door guide, said door support member enabling movement of said door in said first and said second direction;

(c) a door drive means disposed adjacent such aperture for driving said door, said door drive means including a drive member rigidly attached to one of such vehicle and a base member attached to such vehicle, said drive member adapted to receive  
5 at least one level of a power supply means from a vehicle power supply source and generate a driving force, and at least one link means coupled to said drive member at one end and coupled to one of said door and said door support member at a distal end for transferring said driving force to said door; and

10 (d) a means engageable with said door drive means for measuring such at least one terrain attitude, for providing at least one attitude proportional signal and enabling adjustment of said at least one level of a power supply means to compensate for such at least one terrain attitude prior to said door  
15 movement in one of said first and said second directions, said means being disposed in a stationary position and substantially aligned with a directional axis of such at least one terrain attitude.

20 13. The powered door system according to claim 12 wherein said drive member of said door drive means is an electric drive member receiving at least one control output signal being one of pulsed with a modulation and current level signal.

14. The powered door system according to claim 12 wherein said drive member of said door drive means is one of a hydraulic, and a pneumatic drive member.

5        15. The powered door system according to claim 14, wherein said door drive means further includes a control valve means for adjusting said power supply means.

10        16. The powered door system according to claim 12, wherein said powered door system further includes a door controller connected intermediate said means for measuring such at least one terrain attitude and said door drive means, said door controller for receiving at least one command signal from a vehicle controller and said at least one attitude proportional  
15        signal and for enabling said door drive means to move said door.

17. A powered door system for enabling passenger ingress and egress through an aperture of a vehicle operating on at  
20        least one terrain attitude, said powered door system comprising:

(a) at least one door adapted for movement in a first direction to at least partially uncover such aperture and in a second direction to at least partially cover such aperture;

(b) at least one door support member disposed adjacent such aperture and connected to said at least one door with at least one door guide, said at least one door door support member enabling movement of said at least one door door in said first  
5 and said second directions;

(c) a door drive means disposed adjacent such aperture for driving said at least one door, said door drive means including a drive member rigidly attached to one of such vehicle and a base member attached to such vehicle, said drive member adapted  
10 to receive at least one level of a power supply means from a vehicle power supply source and generate a driving force, and at least one link means coupled to said drive member at one end and coupled to one of said door and said door support member at a distal end for transferring said driving force to said at least  
15 one door; and

(d) a door controller coupled to said door drive means and a vehicle controller for receiving at least one door command signal, said door controller including at least one attitude sensor means for measuring at least one terrain attitude and  
20 providing at least one attitude proportional signal, a processor coupled to said at least one attitude sensor means for receiving said at least one attitude proportional signal and for providing at least one proportional drive signal, and a driver means connected to said processor for receiving said at least one



proportional drive signal and for providing at least one control output signal of a predetermined value to such door drive means enabling incremental proportional adjustment of said driving force.

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18. A powered door system according to claim 16 wherein said at least one attitude sensor means is one of a bulk micromachined piezoresistive, a bulk micromachined capacitive, a bulk micromachined resonating beam, and a surface micromachined  
10 capacitive.

19. A powered door system according to claim 17 wherein said at least one attitude sensor means is a surface micromachined capacitive multi-axis sensor.

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20. A powered door system according to claim 16, wherein said powered door system further includes a sensor means for measuring one of vibration, shock, speed and combinations thereof for one of altering said initial movement of said door  
20 and calibrating said at least one attitude proportional signal.

21. A powered door system according to claim 16 wherein said door controller is aligned with at least one terrain attitude directional axis.

22. A method of employing at least one terrain attitude detection for initial motion control of a powered door movement, said method comprising the steps of:

(a) measuring a value of said at least one terrain  
5 attitude;

(b) providing at least one attitude proportional signal proportional to said value of said at least one terrain attitude;

(c) processing said at least one attitude proportional  
10 signal against a predetermined threshold;

(d) providing at least one drive signal proportional to said value of said at least one terrain attitude; and

(e) converting said least one drive signal into at least one control signal enabling such initial powered door movement  
15 to overcome such at least one terrain attitude.

23. The method of claim 20 wherein said method includes an additional step of measuring one of vibration, shock, speed and combinations thereof for calibrating said at least one attitude  
20 proportional signal.